

The Future of Storage

Storing your digital world

Maxtor Corporation

Stephen DiFranco

Vice President Corporate Marketing

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History of Storage Demand



40,000 BC 0 AD 1947 AD 2002 AD

From EMC-UC Berkeley Study

From Vision to Reality

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Our Digital Lifestyle Demands Storage

Everyday we wake up and start using data that is stored or cached on hard disk drives.

- Email messages and attachments
- Voicemail messages
- Television broadcast content
- Radio station broadcasts
- Cell phone networks
- Finance systems, credit cards, banking
- Personal PVR TV recording
- MP3 storage and authoring
- DVD and video editing and playback
- Home game Consoles
- And all computers used in business or home



From Vision to Reality

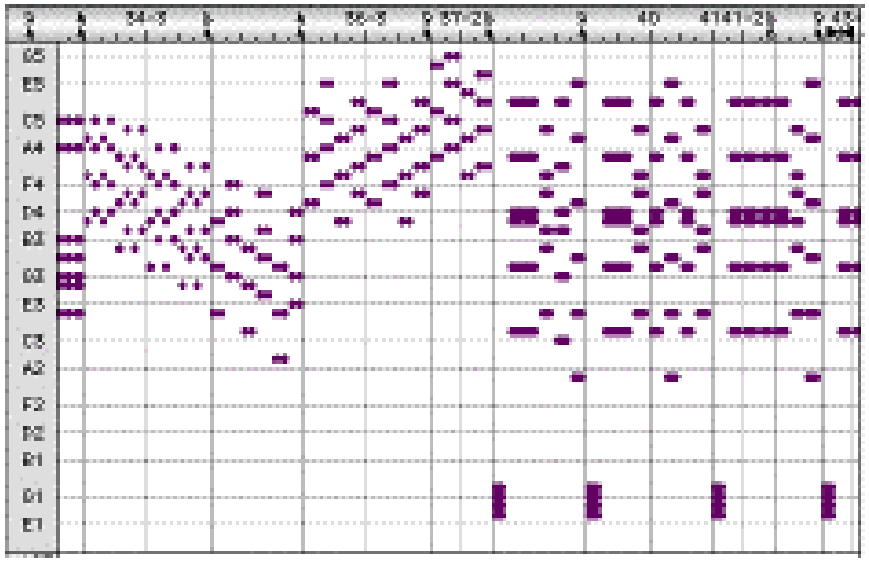
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First Digital Storage Systems

The Player Piano Was the First Use of Digital Entertainment. It Allowed for the Accurate Playback of a Musician's Actual Work - in the Digital Format of Holes / No Holes.
Most of All It Captured the Nuances of the Artists Performance - As Today Voicemail Lets You Play Back the Nuances of Voice.



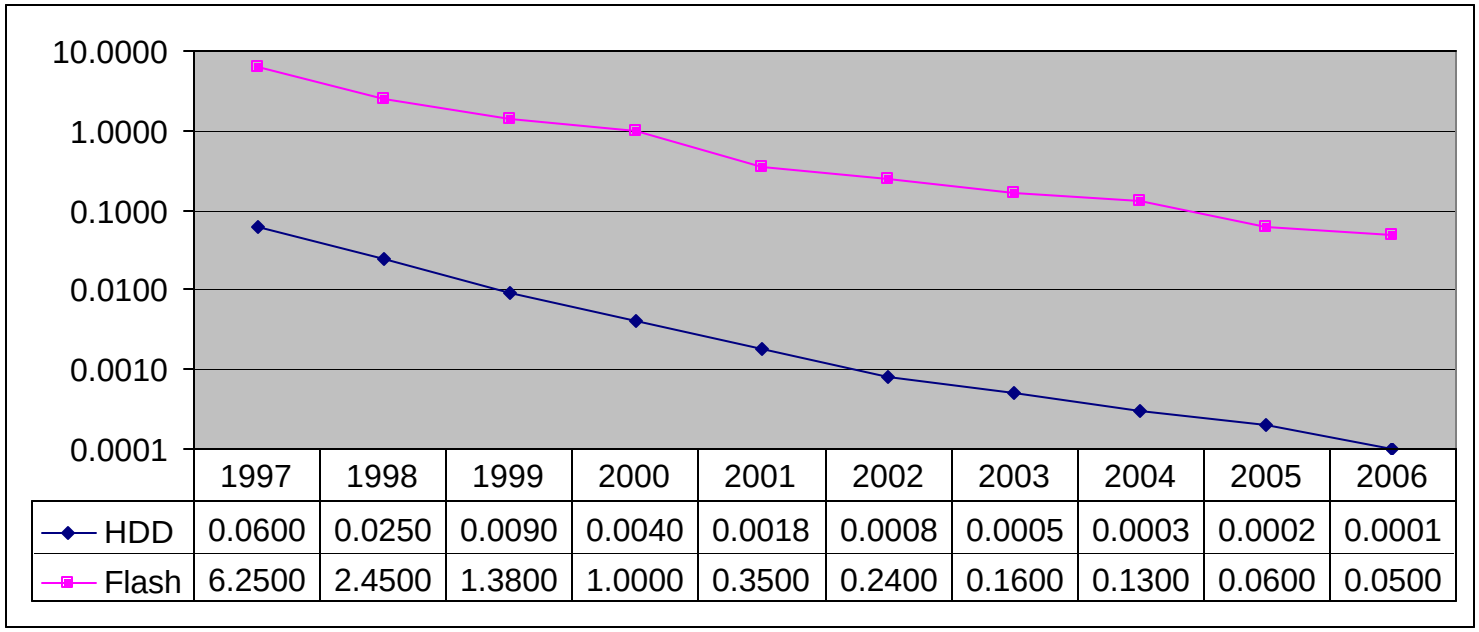


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Cost Per MB for Disk Drives Expected to Keep Ahead of Flash



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
HDD	0.0600	0.0250	0.0090	0.0040	0.0018	0.0008	0.0005	0.0003	0.0002	0.0001
Flash	6.2500	2.4500	1.3800	1.0000	0.3500	0.2400	0.1600	0.1300	0.0600	0.0500

Information from Gartner/DataQuest 2001

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Enterprise Data Storage



- Development code
- Email
- Productivity files
 - Word, Excel, PowerPoint
- MPEG, JPEG, etc

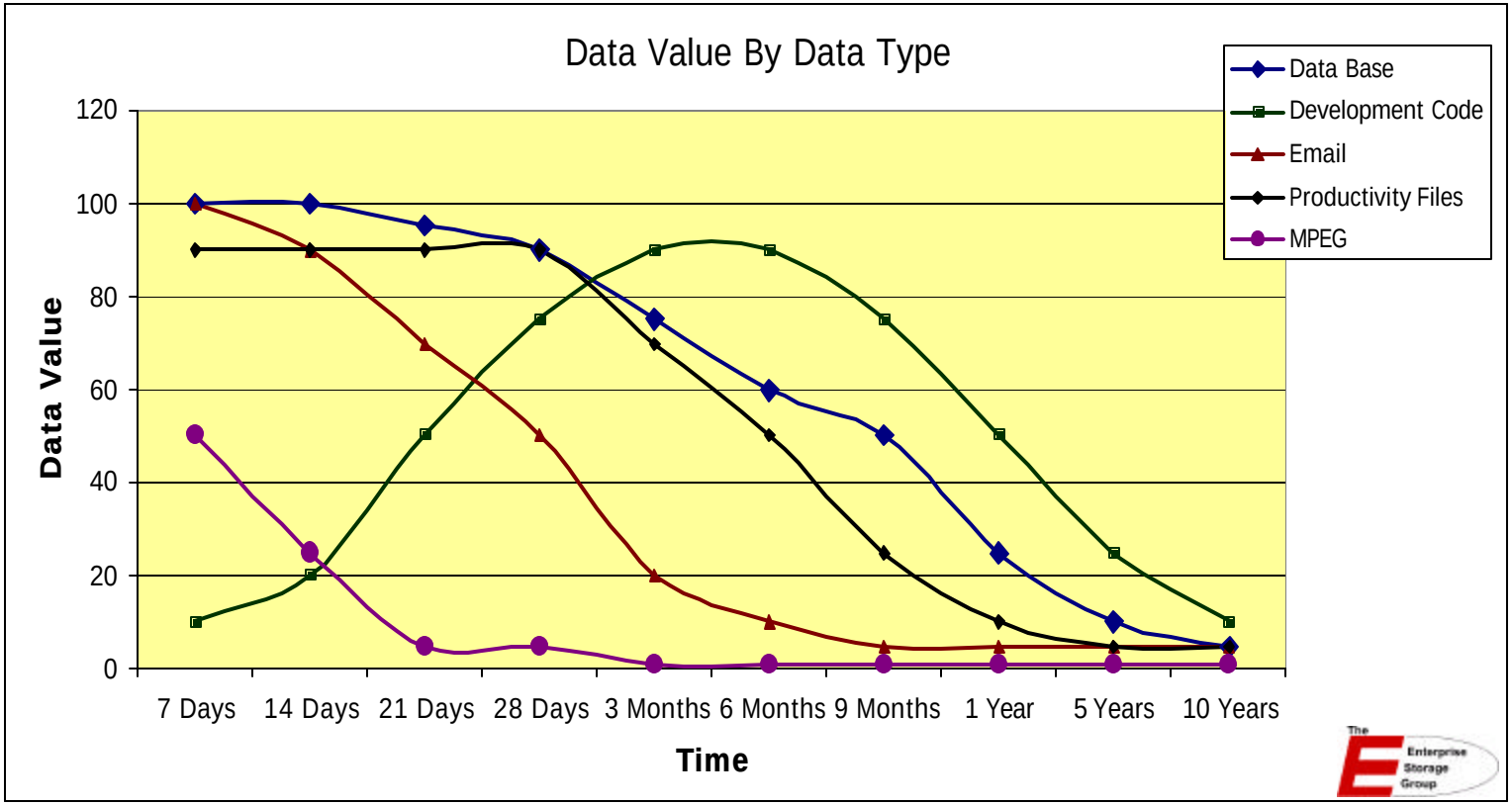
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Lifecycle of Enterprise Data

Value of Data Ages & Changes with Time

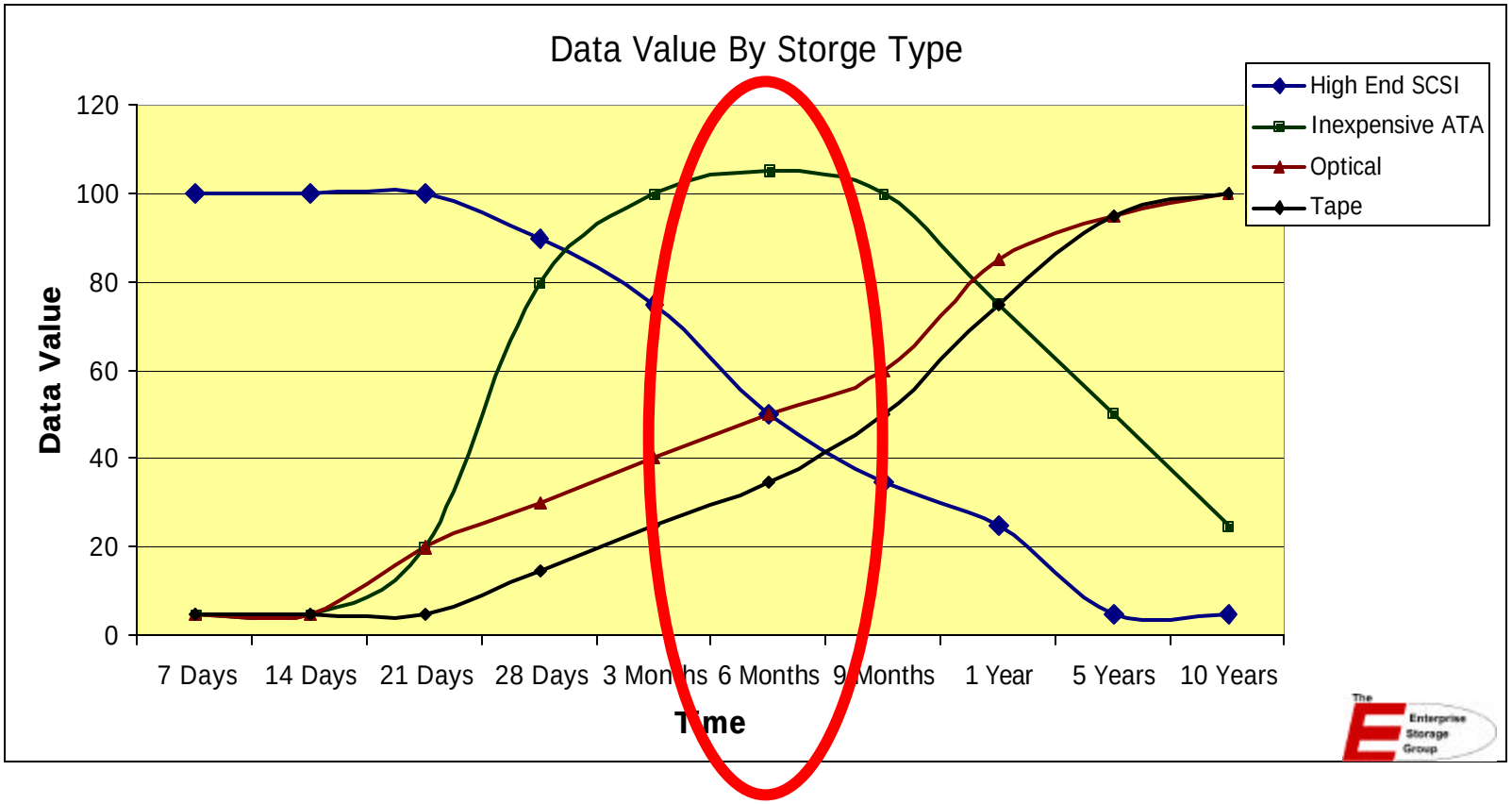


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Enterprise Storage Subsystems



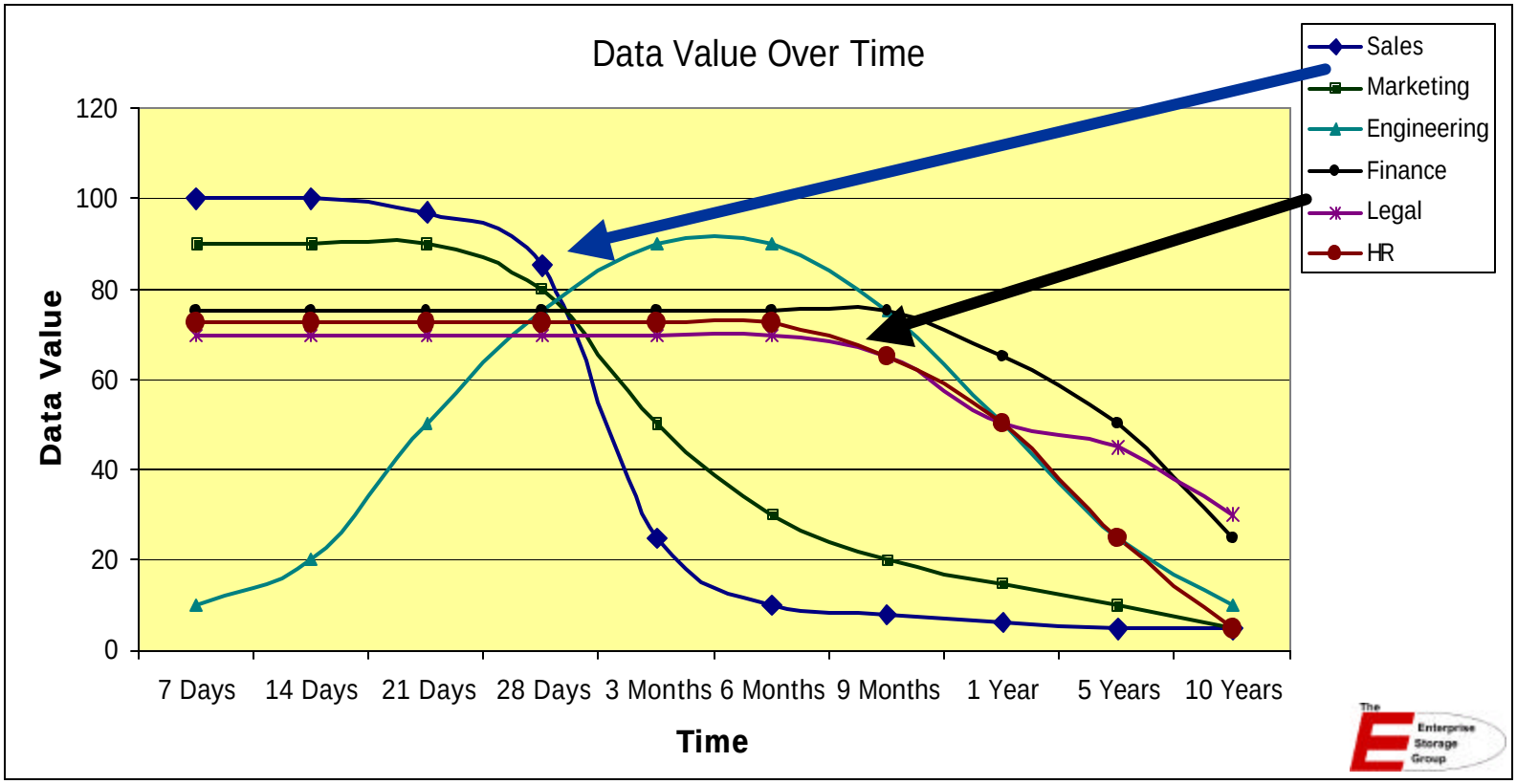
Data "matures" at six months and becomes "archivable"

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Classifying Enterprise Data



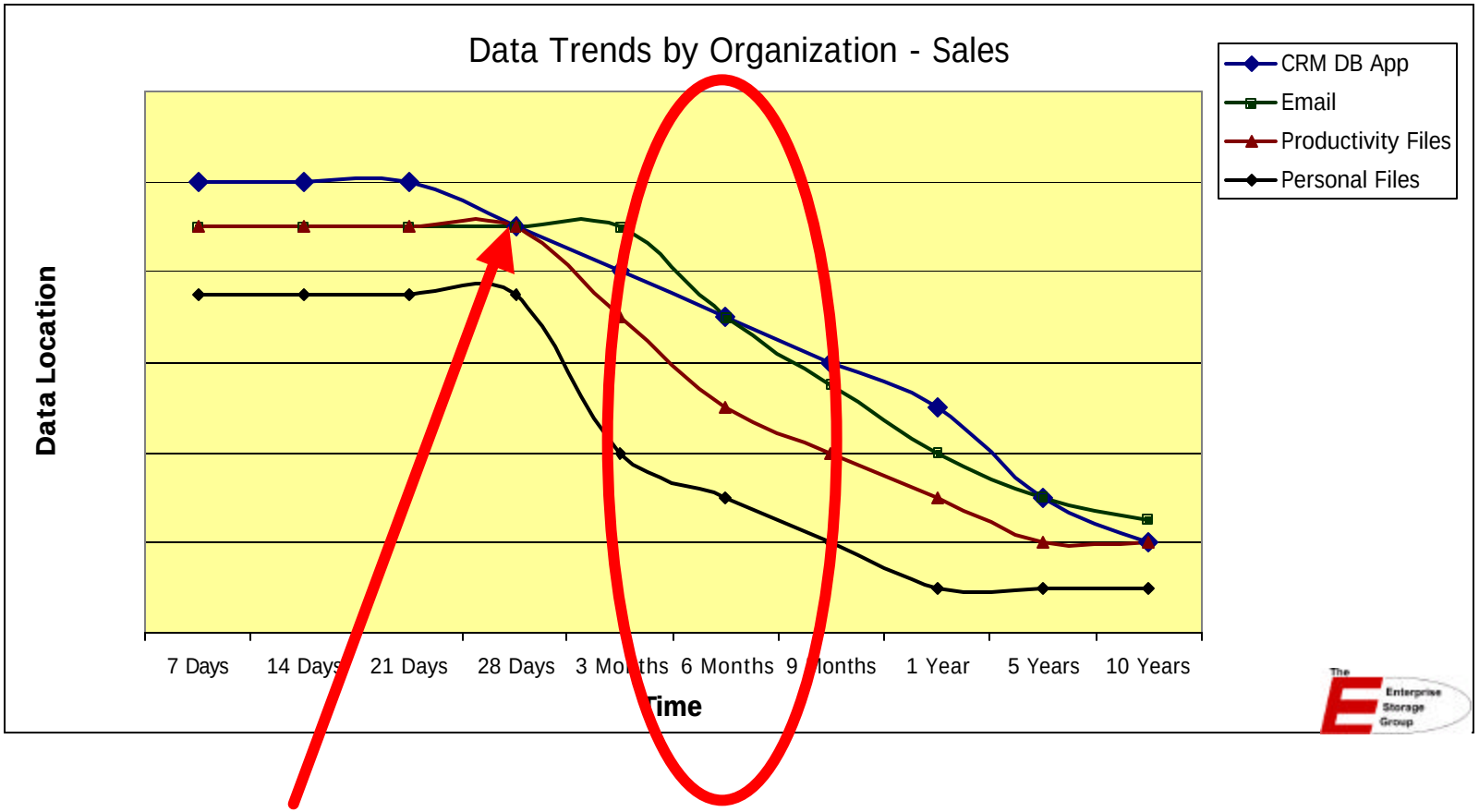
Classifying data and organizations determines other facets of infrastructure that will have to be set up such as HSM or replication for example. Also, understanding if the Finance department relies on a database for quarter end processing or Excel spreadsheets helps to pinpoint specific files that need to be managed differently within different organizations.

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An Enterprise Data Map



Transaction Data

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Digital Storage in Your Car?



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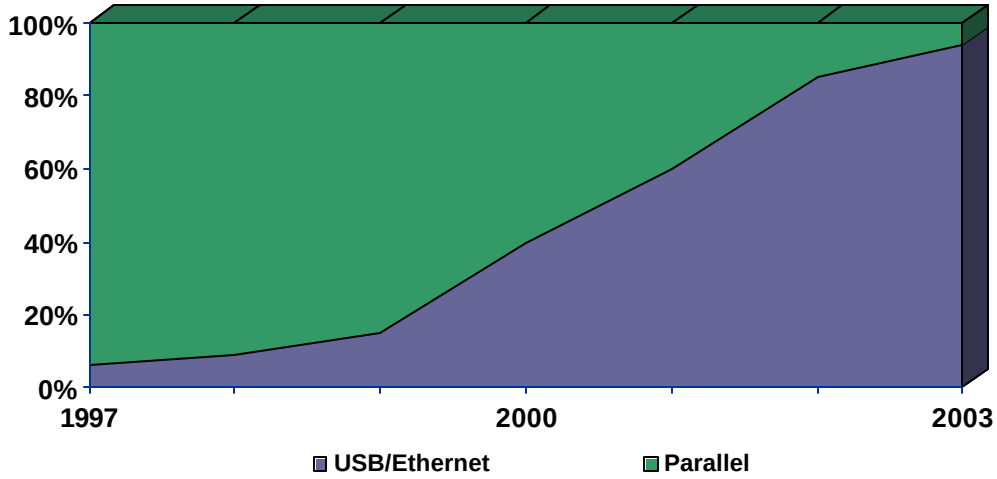
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Transition to Serial Connections

Industry Example:
Interface Migration for Printers





Printers are well on their way in migrating away from parallel interfaces, driven by the “usability” improvements and features that a serial interface enables.

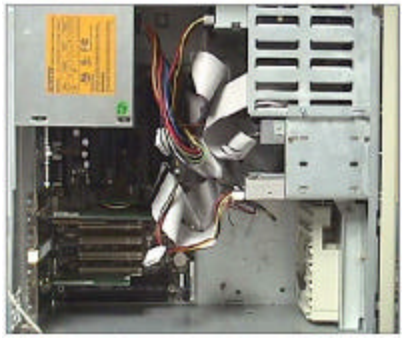
Maxtor Market Estimate for US market - based on 800K printers sold in 2001

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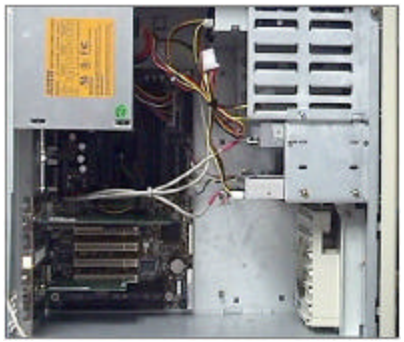
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Why SATA Will Replace Parallel ATA



PATA Cabling



SATA Cabling



SATA Server Cabling

- Change driven by chipset vendors need to reduce pincount & voltages
- SATA is 100% software compatible with PATA HDDs
- Smaller connectors & cables improve airflow, are ideal for small form-factor devices and support backplane configurations…
- Blindmate connectors & hot-plug support enable SATA HDD applications beyond the PC
- Emerging controllers will facilitate bridging SATA HDDs to storage networks
- Both offer systems integrators choices & new opportunities

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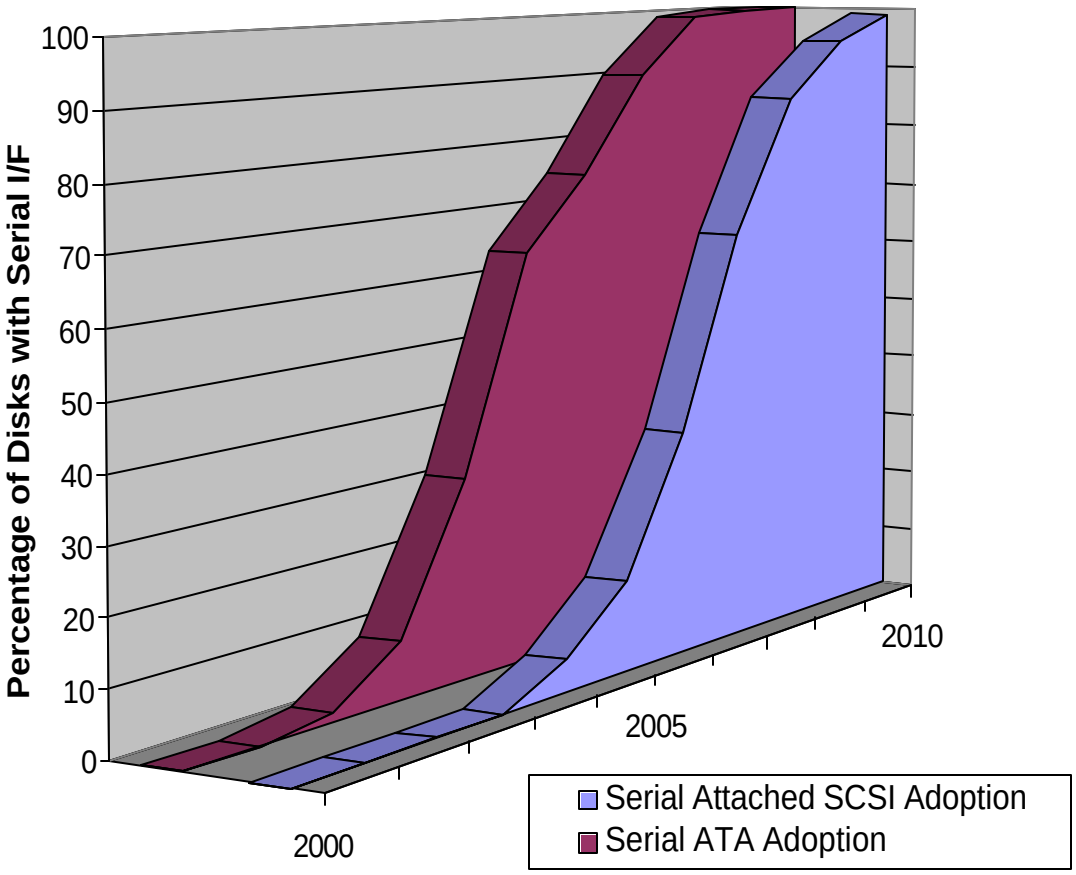
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Maxtor Perspective on Serial Migration

The desktop and enterprise markets have a different set of dynamics that will drive different serial interface transitions rates.

Serial ATA adoption is much steeper based on technology needs of chipset vendors and a simpler, more “closed” systems environment.

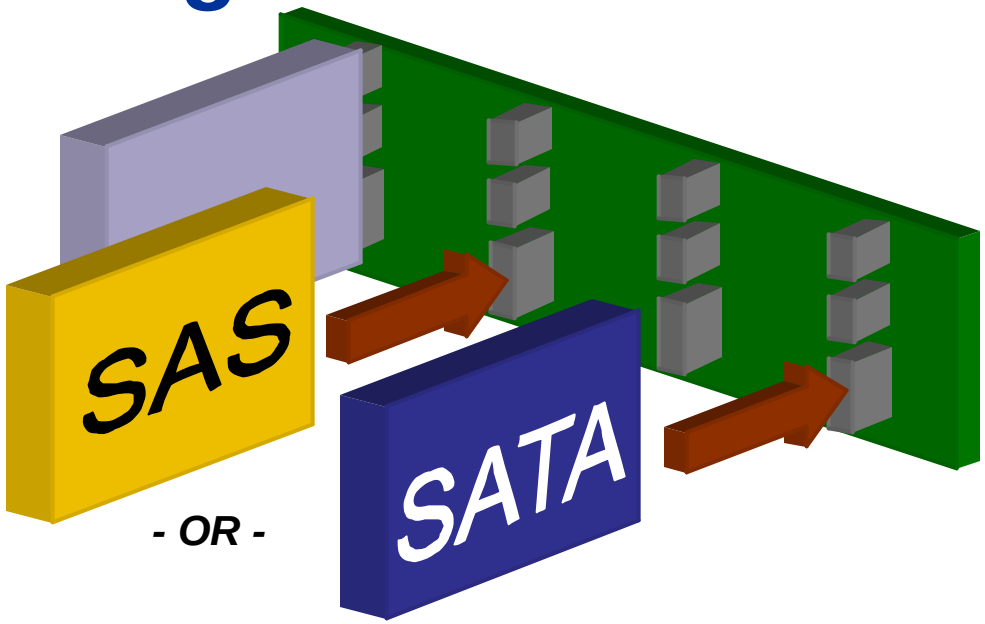


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Enabling Choices For Customers



- A “properly designed” backplane can accommodate either SAS or SATA disk drives
- SATA/High-Capacity disk drives can be used to enable “near-line” or tape augmentation applications
- SAS/High-Performance disk drives can be used to enable “on-line” and performance-oriented applications
- Enables OEMS, VARs & Integrators the ability to re-use designs and more easily broaden their product offerings

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Enabling Choices for Customers:
SATA-SAS Subsystem Example

When drives can share a common controller & back plane, system designers & integrators are given more opportunities…

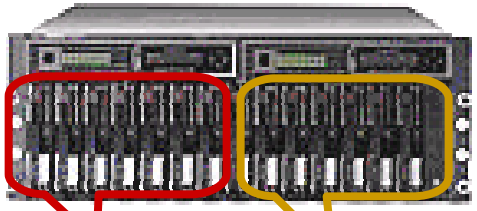


Dual port SAS drives for main stream server applications

SATA drives integrate disk to disk backup in the server to shorten backup and restore times

SATA drives with dual port, switched carriers for networked file storage

Add-on JBOD or RAID storage with mixed drive classes



SAS drives

SATA drives

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Storage Is Migrating to Serial Interfaces

Parallel Interfaces

ULTRA ATA/100



ULTRA320 SCSI

Serial Interfaces

SERIAL ATA

Serial Attached SCSI

Serial interconnects are the planned, natural progression for storage interfaces, enabling increased performance & new applications while simplifying the integration of storage into PCs, servers, subsystems and consumer electronics devices

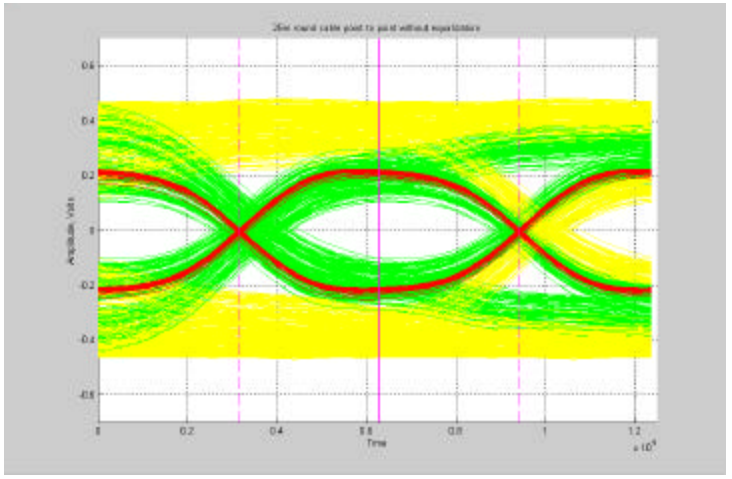
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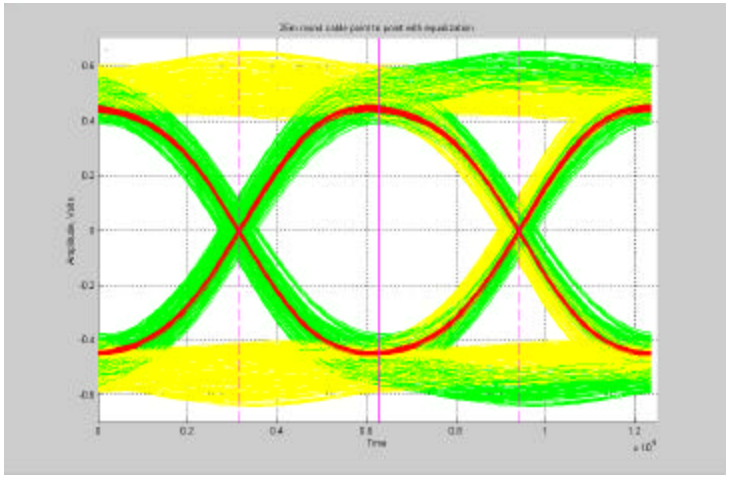
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MaxAdapt
The AAF Difference

- Maxtor's MaxAdapt™ AAF (Adaptive Active Filtering) implementation improves signal integrity and as a consequence maximizes system performance
- Signals with AAF are crisper and have a better peak-to-peak amplitude definition
- AAF enhances electrical signal margins reducing the negative effect of signal losses in back-planes and cables



Signal Integrity without AAF



Signal Integrity with AAF

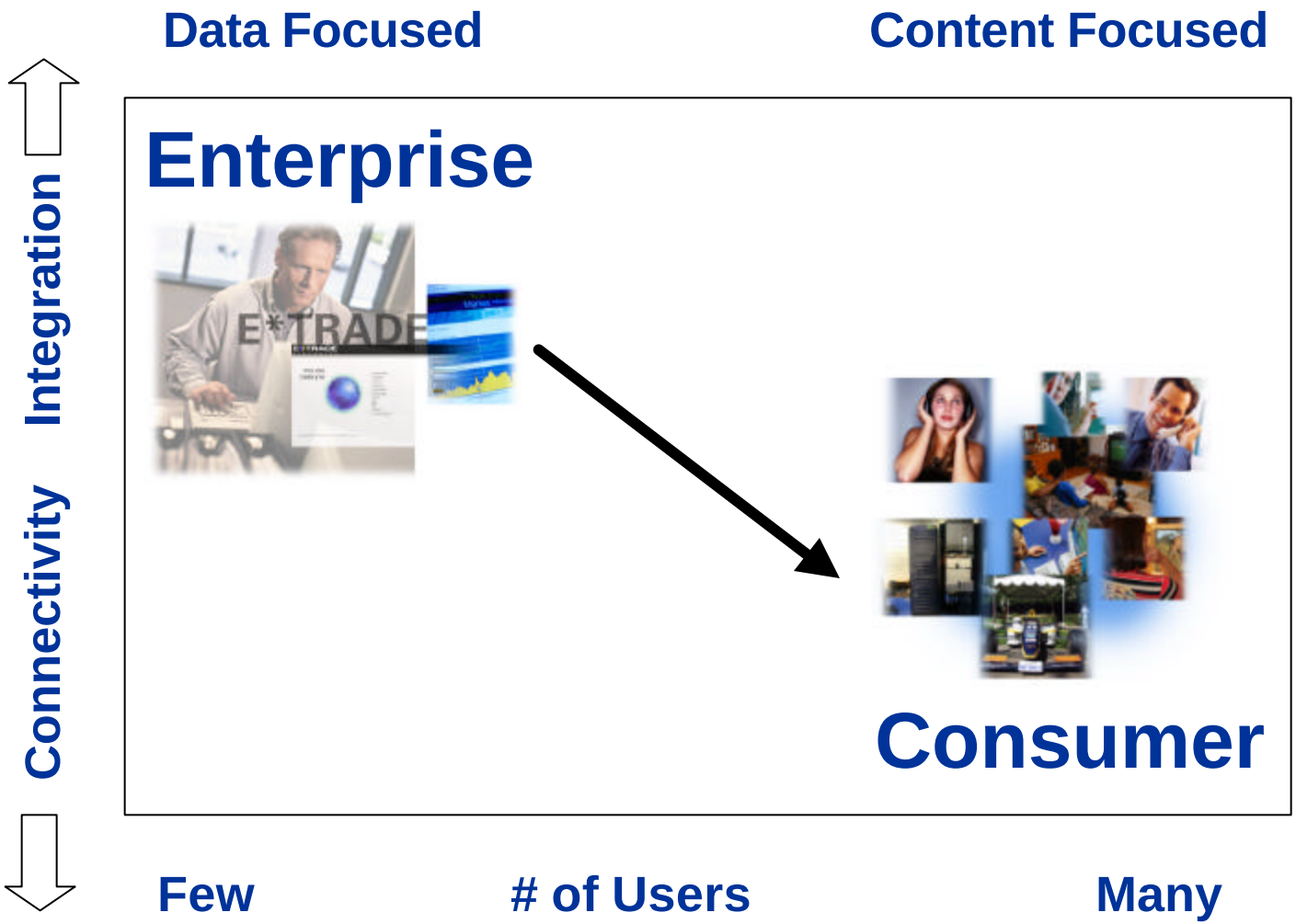
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ULTRA320 SCSI

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Movement of Storage



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OneTouch Personal Storage



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Storing You Digital Entertainment



EchoStar
Satellite
Set Top Box



Sony PS2





TIVO PVR



ZAP Media
Server



iPOD MP3



Scientific Atlanta
Cable Set Top Box



Audio Request
Jukebox

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Totally Personal



REMOVABLE STORAGE

EasyDiskUSA EasyDisk 16MB USB Drive



Enlarge image

EDITORS' RATING

7.8

Service and support	7
Setup and ease of use	9
Performance	7
Features	9

What these scores mean

Where to Buy

All stores & prices

PROS

- Solid utility suite
- Password and write protection
- USB extension cord included
- Bargain price

CONS

- Limited support
- Won't work with the first edition of Windows 98

USER RATINGS

Overall score: 8.4 (7 votes)

Read user reviews

Rate this product

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DiamondMax
DiamondMax Plus

MaXLine

CE-Brand

DiamondMax
Plus

Atlas





CE Devices



Desktop PC



Near-Line Storage



Servers & Storage



Large Enterprise

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The Digital World



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China

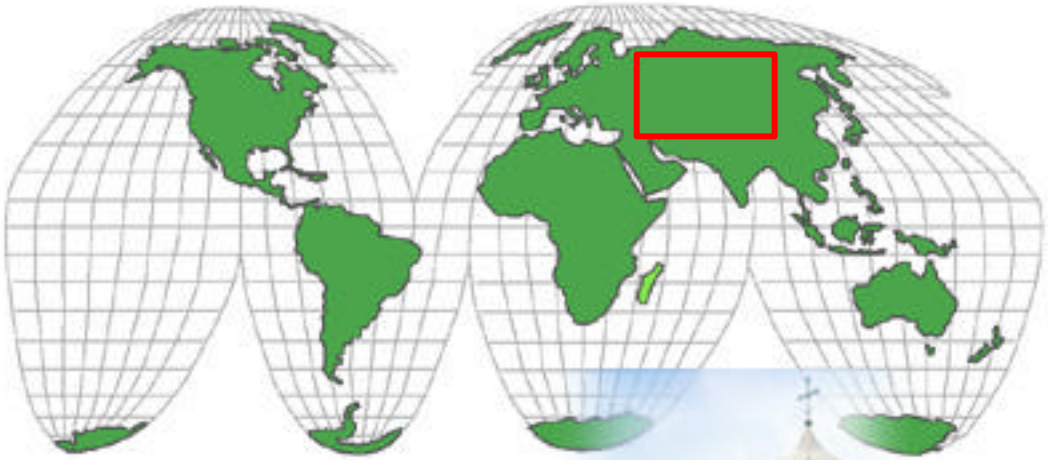


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Eastern Europe



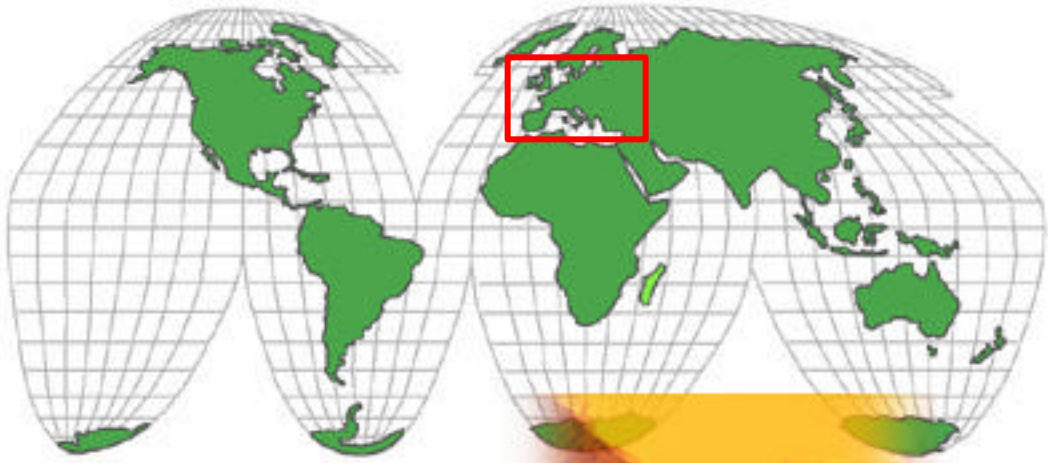


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Western Europe



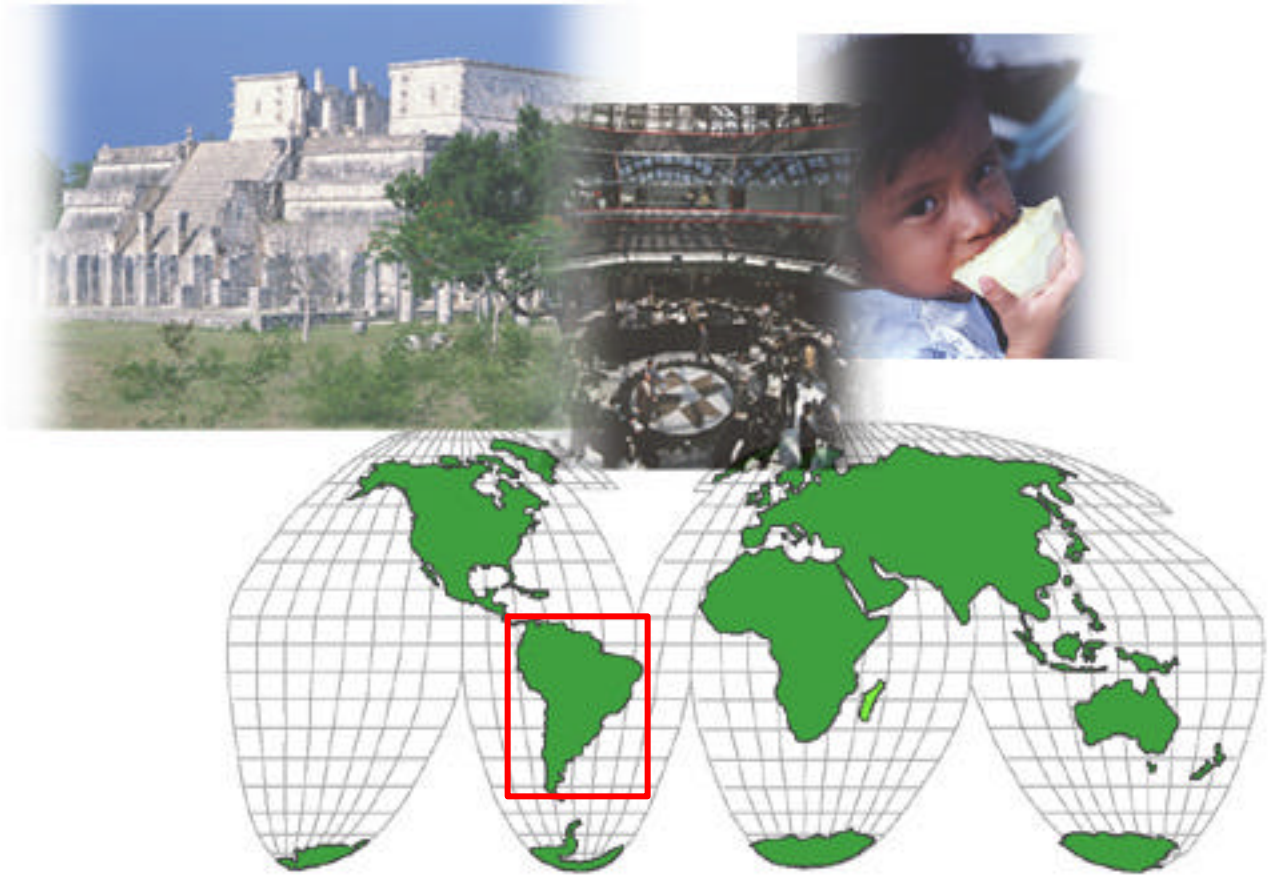


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Latin America



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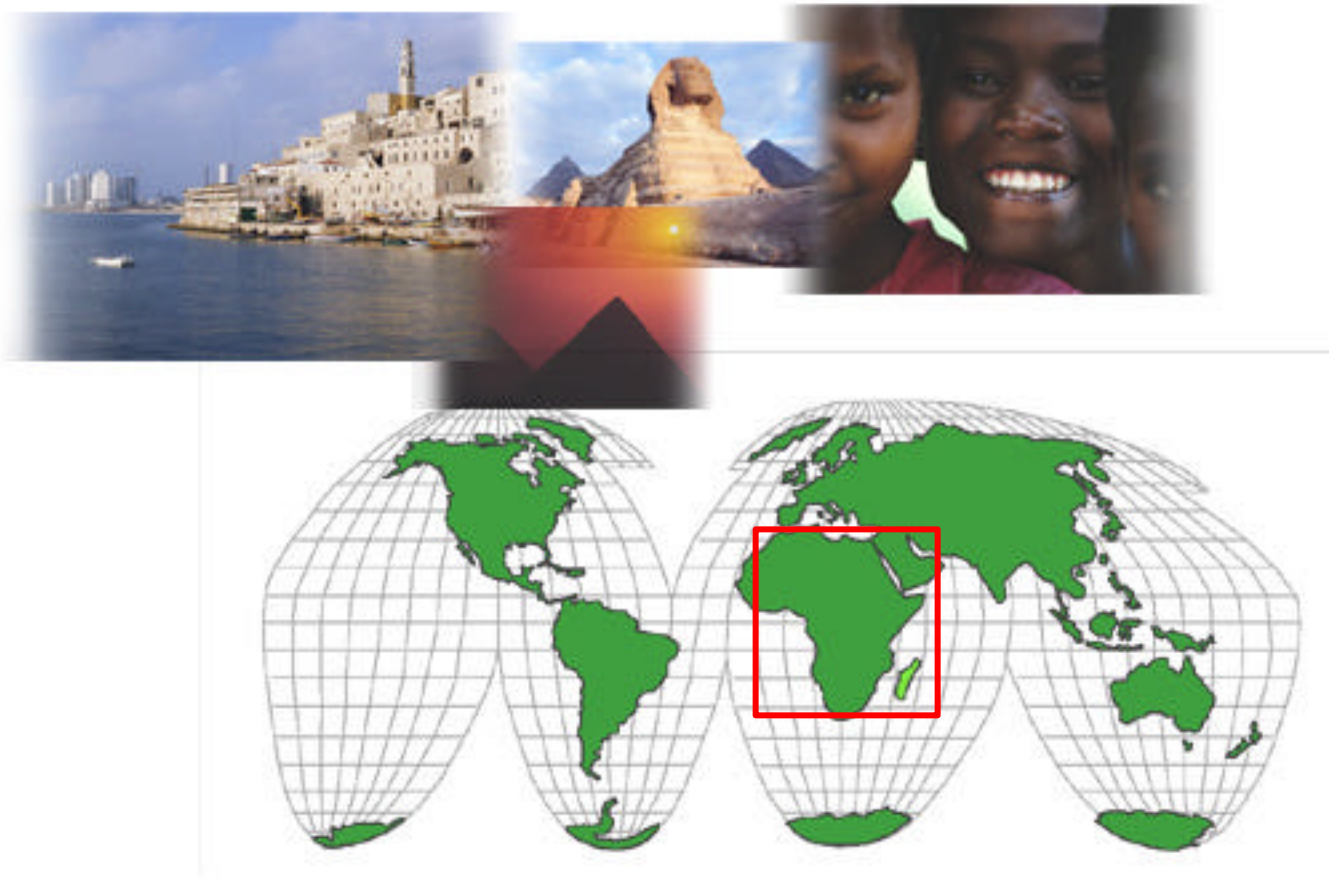
Japan





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Africa and Middle East



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Future Disk Technologies

IBM Millipede
Nanometer technology recording using tips from atomic force microscopes using multiple arrays of tips to manipulate impressions in a ploymer (plastic) surface. Concept is similar to punch cards but on a very small scale. Currently only in prototype stage of development, May be available by 2004/2005 but cost is not defined

New Technology Optical
It was to replace hard drives . The two leading developers Terastor and Quinta are both now gone and no optical products compete with HDD

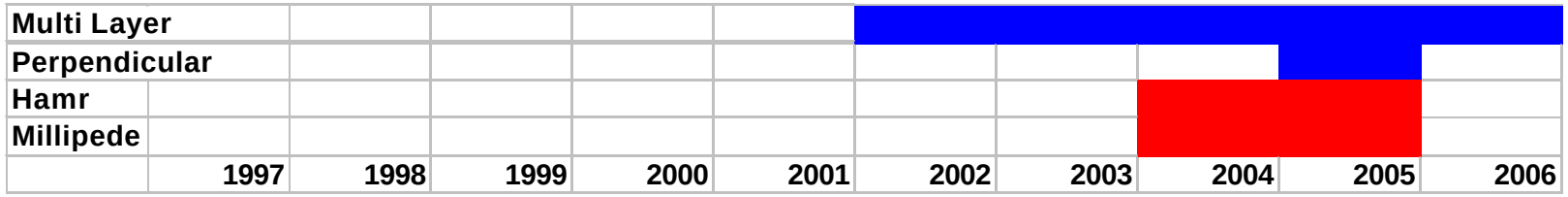
CD/DVD: CD is 700MB and DVD is only 4.7GB. Both are too slow to challenge HDD's

Holographic Storage: Much promised in the early 1990's Some consortia still working but prototypes cost over $1 Million

Magnetic Multi-layered Media; (IBM Pixidust) layering the media allows stabilization of magnetics at high areal densities This is now being seen in some high end and mobile products

Perpendicular: Also around for many years in the R&D phase now looking to make an appearance in 2004

HAMR: Heat Assisted Magnetic Recording. Using lasers to quickly heat then cool a point on the media allowing the magnetics to re-establish thermal magnetic stability. Problems will be in cost and control of the lasers and potential data loss possible by heat bleeding into adjacent cells.



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Sci Fi Storage of the Future
If Current Trends Continue...

- Disk drives will be able to hold over 1 exabyte per platter in 2030 – Terabyte Disk in 2005
- Today's MP3 sized music players with disk drives would hold 286 billion songs in 2030



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Outline

- History of Storage Growth
- **Universal Storage Use**
- Near Future Storage Options
- The Future of Storage
 - Intelligent Storage
 - How much can we make or use?

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Outline

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Why the Demand for Storage?

- Instantly Access & Recall our Digital World
- Dependence on remote recall of data
- Ease of integration of storage into systems
- Ever lowering cost to keep more data

Has led to Ubiquitous use of storage

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Storing your Digital World



Stephen DiFranco

VP of WW Corporate Marketing & Branding

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The Near Future of Storage

- Simpler
- Faster to build
- Tolerant - signal adaptation technology
- Hot plug interfaces
- Very Large Capacities
- Solutions available to enable entry to near-line and archiving markets

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